MUSC EARLY DETECTION AND IMAGING OF LUNG CANCER PROGRAM
A CENTER OF EXCELLENCE

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I. THE LUNG CANCER CHALLENGE

Lung cancer kills more people in the U.S. than breast, prostate, colon, liver, kidney and melanoma cancers combined. The National Cancer Institute estimates that, in 2006, nearly twice as many women will die from lung cancer than from breast cancer; more than three times as many men will die from lung cancer as from prostate cancer. Since 1972, when Congress declared war on cancer, the 5 year survival rates for breast, prostate and colon cancers have risen to 88%, 99% and 65% respectively. Each of these cancers has an active screening program. Lung cancer's 5 year survival rate is still only 15% and screening for lung cancer is under evaluation and currently not recommended. This year alone, 162,000 people will die of lung cancer in the U.S. Based on statistics compiled by the National Cancer Institute, one in 14 people born today will be diagnosed with cancer of the lung during their lifetime. In South Carolina, lung cancer claims almost 3,000 lives each year.

Using smoking prevalence rates, there are between 6.8 and 14 million U.S. veterans that are at an increased risk for developing lung cancer. In addition, over 33% of the 1.4 million active duty personnel are currently smokers. Two studies have shown that Veterans are 25% to 75% more likely to develop lung cancer than the general public. Vietnam veterans who were exposed to Agent Orange are just now entering the age bracket when lung cancer is most likely to manifest itself.

Though mortality has declined slightly in recent years, the five year survivorship of lung cancer patients remains low – approximately 16 percent. However, survival is high amongst those who have disease diagnosed at an early stage (approximately 70%). Mortality among men has seen a slight decline in recent years, but has remained steady among women. Further, the incidence and mortality from lung cancer among minorities has risen.

Perhaps the only way to change the five-year survival rate is through early detection.

II. FOCUS ON IMAGING/ EARLY DETECTION

CT (computed tomography or CAT) screening is the best method to detect lung cancer in its earliest stage. The majority of lung cancers originate as a small growth or nodule in the lung. Screening CT scans are extremely sensitive in detecting nodules—much smaller than can be viewed on a conventional chest Xray. In fact, recently published articles on CT screening found that the majority of lung cancers revealed on CT scanning could not

be detected on a chest X-ray that was performed simultaneously. The majority of lung cancers detected by CT are early stage.

PET (positron emission tomography) is a powerful, non-invasive, diagnostic tool that detects biochemical changes in body tissues. To feed their rapid growth, tumors consume more glucose than healthy tissues. The PET scanner, which creates a color-coded image of the body's chemical function, reveals the cancer as red "hot spots" of activity.

Under the sponsorship of the U.S. Department of Defense, 8 researchers at the Medical University of South Carolina (MUSC), and in partnership with General Electric (GE), collaborated to create a team of experts with broad expertise in imaging/radiology, lung medicine, chest surgery, public policy, statistics, economics, image analysis, nuclear medicine, and computer aided detection techniques.

This team, under this DOD initiative, has devoted the past 3 years to developing a more sensitive methodology for the early detection of lung cancer:

A. Clinical Prediction Model

Clinical and radiological data is being combined to develop a mathematical algorithm for improving our ability to predict whether or not a nodule found on screening CT is cancer. Researchers at MUSC and GE expect to produce a tool that clinicians can routinely use in evaluating their patients' risk for lung cancer thus sending them for surgery when needed but protecting them from unnecessary risk when surgery is unnecessary.

B. Measurement of Lung Nodules by CT scanning

Partnered with GE, investigators at MUSC conducted experiments using a lung phantom to determine the optimal parameters to use when measuring the volume of lung nodules detected on CT scan. This achievement will enable doctors to more accurately determine if a lung nodule detected on CT scan has grown and is potentially cancer.

C. Development of Computer Software for Detection of Lung Nodules

MUSC investigators have been partnering with GE scientists to develop Computer Aided Detection (CAD) software to help radiologists determine whether nodules detected by CT scan are cancerous or benign.

A. Readers Accuracy

MUSC researchers are investigating the impact of training and experience on the accuracy of radiologists' interpretation of CT scans of the chest. The effect of the CAD interpretation on the "confidence" of the radiologist-reader is also under investigation. These findings will aid in adjusting the lung cancer screening methodology for operator error that invariably influences clinical interpretations.

B. Respiratory Motion in PET Scanning

MUSC investigators are quantifying the effect of respiratory motion in patients undergoing CT scanning for lung cancer. This will provide practitioners with guidelines which will increase the accuracy of lung nodule evaluation, enabling doctors to detect malignancies at smaller sizes and at earlier stages.

III. CENTER OF EXCELLENCE FOR EARLY CANCER DETECTION AND IMAGING OF LUNG CANCER

The vision of Hollings Cancer Center at MUSC is to become the region's leading resource for those at risk and diagnosed with lung cancer. The goals of the center are to provide leadership in the areas of research, prevention, tobacco control, public policy, screening, diagnosis, treatment, and palliative care for those faced with lung cancer. We are well positioned to carry out this goal as we are participating in the national lung screening trial and have the infrastructure in place to continue to evaluate this patient population.

MUSC Investigators propose the development the ***Center of Excellence in Early Detection and Imaging of Lung Cancer*** — to further this line of research and patient care. The primary goals are:

- Implement a screening program which assesses the clinical and economic impact of screening a population at risk for lung cancer while improving the evaluation and management of abnormalities discovered during the screening process.
- Develop novel screening techniques using genetic markers to identify those at the highest risk for developing lung cancer so that those most at risk will be screened, while sparing unnecessary testing for others.
- Create and evaluate novel radiological techniques to advance the ability to both diagnose lung cancer in an earlier more treatable stage and to differentiate benign from cancerous lesions.

The Hollings Cancer Center is uniquely positioned to build a successful ***Center of Excellence in Early Detection and Imaging of Lung Cancer.*** We are recognized by cancer leaders in the state and nationally. We are the only cancer center in the state that is able to provide global support and infrastructure for cancer care in South Carolina. As described above, the collaboration of expert researchers and clinicians is already in place to facilitate the development of the most effective methodology for early lung cancer detection. Early detection of lung cancer leads to more effective treatment and outcomes. Because lung cancer is the most common cancer killer in the United States and among our nation's military, this center is of vital importance to our veterans and active duty military.